



**UNIVERSITY OF NORTH BENGAL**  
 BCA Honours 3rd Semester Examination, 2020

**CC7-BACHELOR OF COMPUTER APPLICATION (33)**

**DISCRETE STRUCTURES**

Full Marks: 60

**ASSIGNMENT**

*The figures in the margin indicate full marks.*

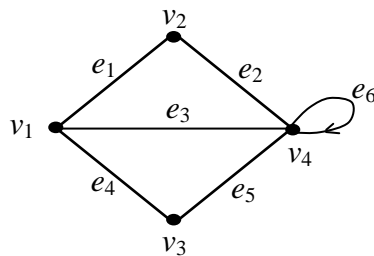
**Answer any *three* questions from the following**

20×3 = 60

1. (a) Explain injective, surjective and bijective mappings with examples. 10
- (b) Define function  $f(n)$  as follows.  $f(1) = 3$  and  $f(n) = n * f(n-1)$  when  $n > 1$ . 6  
 Use induction to prove that  $f(n) > 2n$  for all  $n \geq 1$ .
- (c) Draw the graph whose adjacency matrix is: 4

$$\begin{bmatrix} 0 & 1 & 2 & 1 \\ 1 & 0 & 1 & 0 \\ 2 & 1 & 1 & 2 \\ 1 & 0 & 2 & 0 \end{bmatrix}$$

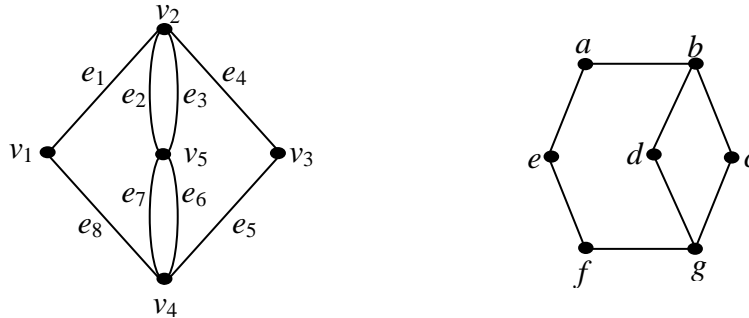
2. (a) Explain Domain and Range of Relation with example. 4
- (b) Write incidence matrix for the following graph: 4



- (c) (i) How many distinguishable ways can the letters of the word HULLABALOO be arranged in order? 4
- (ii) How many distinguishable ordering of the letters of HULLABALOO begin with U and end with L? 4
- (iii) How many distinguishable ordering of the letters of HULLABALOO contain the two letters HU next to each other in order? 4

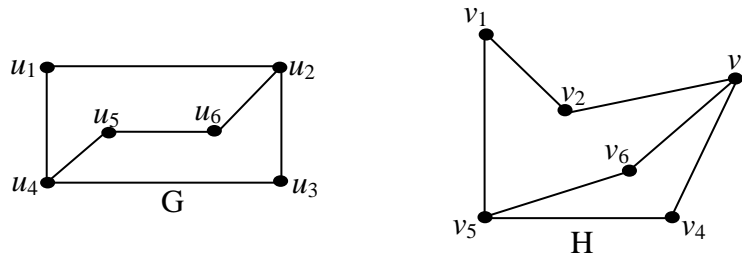
3. (a) Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  and  $g : \mathbb{R} \rightarrow \mathbb{R}$  be two function such that  $f(x) = x - 1$ ,  $g(x) = x/2$  then find  $f \circ g$  and  $g \circ f$ . 10

(b) Determine whether or not the following graphs have Euler circuit and Hamiltonian circuit? 10



4. (a) If  $f : Z \times Z \rightarrow Z$ , where  $Z$  is the set of integers and  $f(x, y) = x * y = x + y - xy$ . Prove that the binary operation  $*$  is commutative and associative. Find the identity element. 6

(b) Examine whether the following pair of graphs are isomorphic or not. 4



(c) Seven women and nine men are on the faculty in the mathematics department at a college.

(i) How many ways are there to select a committee of five members of the department if at least one women must be on the committee? 2

(ii) How many ways are there to select a committee to five members of the department if at least one women and at least one man must be on the committee? 2

(d) Prove by induction that  $7^{n+2} + 8^{2n+1}$  is divisible by 57 for all non-negative integers  $n$ . 6

5. (a) Assuming  $f : Z \rightarrow Z$ , identify whether the following is a function, onto function, one-to-one function, bijection: 4

$$f(x) = x/2 \text{ if } x \text{ is even; } 2x - 1 \text{ if } x \text{ is odd}$$

(b) Write the adjacency matrix of the digraph 4

$$G = \{(v_1, v_3), (v_1, v_2), (v_2, v_4), (v_3, v_1), (v_2, v_3), (v_3, v_4), (v_4, v_1), (v_4, v_2), (v_4, v_3)\}.$$

Also draw the graph.

(c) Prove by induction that  $1^2 + 2^2 + 3^2 + \dots + n^2 = n(n+1)(2n+1)/6$  for all  $n$ . 4

- (d) How many ways are there to select 12 countries in the United Nations to serve on a council if 3 are selected from a block of 45, 4 are selected from a block of 57, and the others are selected from the remaining 69 countries? 4
- (e) A club has 25 members. How many ways are there to choose a president, vice president, secretary and treasurer of the club, where no person can hold more than one office? 4
6. Write short notes on the following:  $5 \times 4 = 20$
- (a) Dijkstra's shortest path algorithm
  - (b) DFS or BFS
  - (c) Prim's or Kruskal's MST algorithm
  - (d) Methods of Tree traversal.

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